

FIG. 1

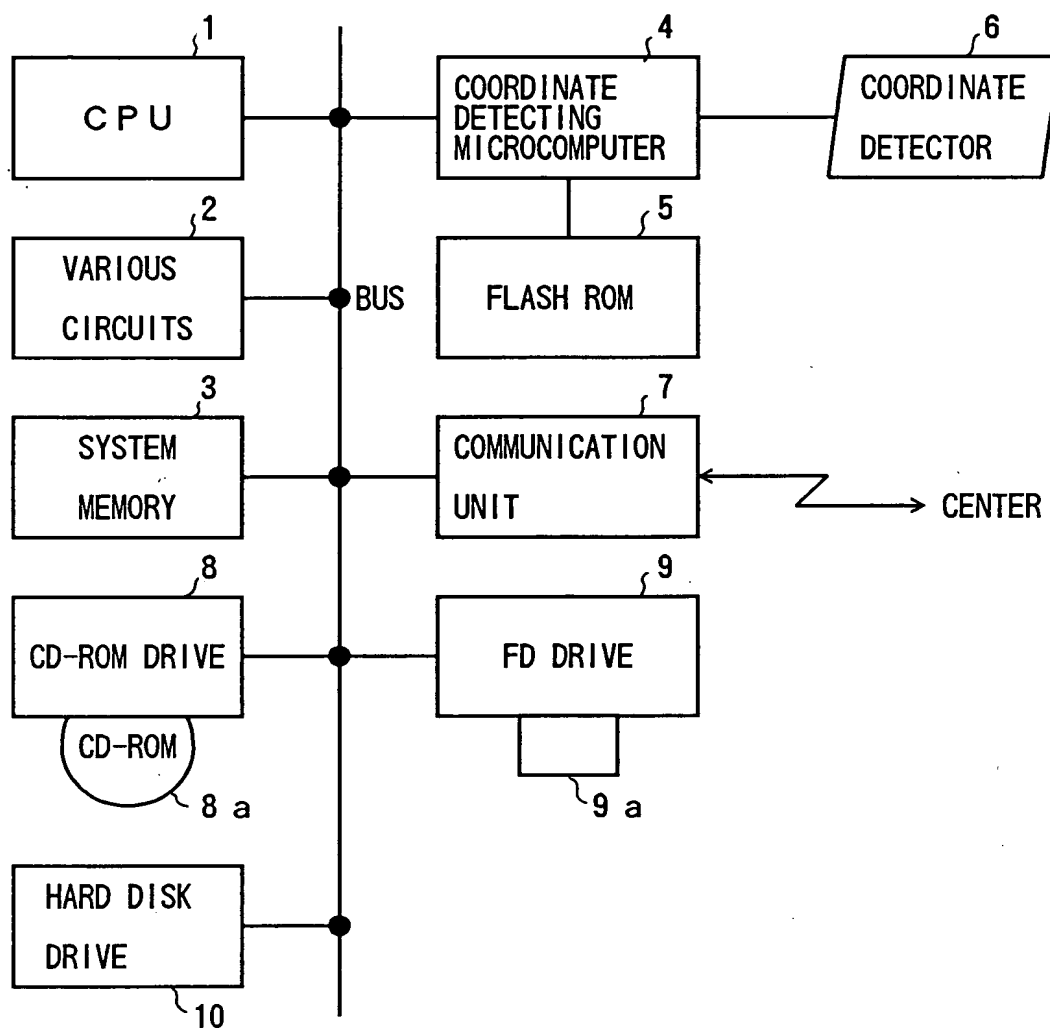


FIG. 2

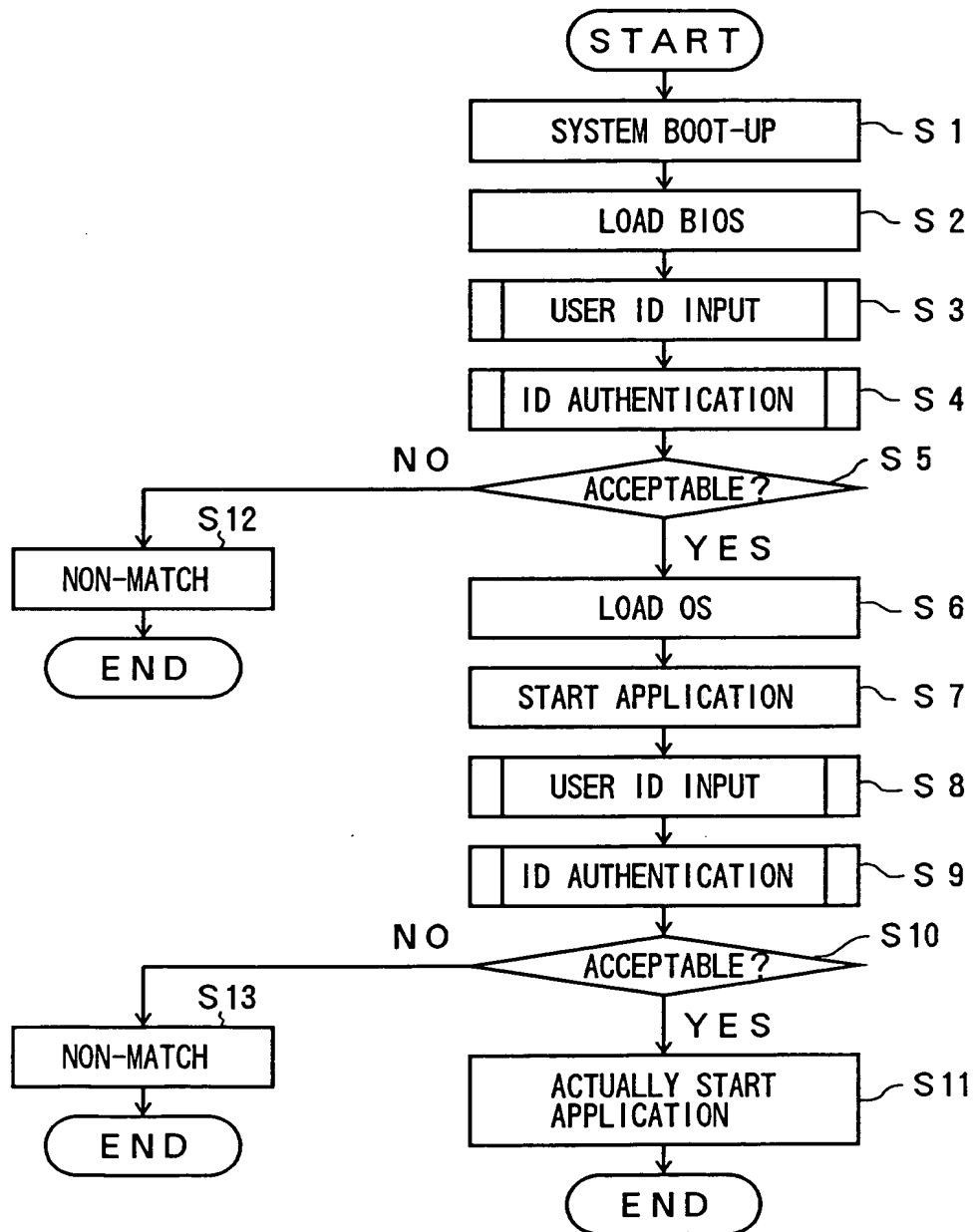


FIG. 2

# FIG. 3

SOFTWARE OF CPU 1

COORDINATE DETECTING  
MICROCOMPUTER 4

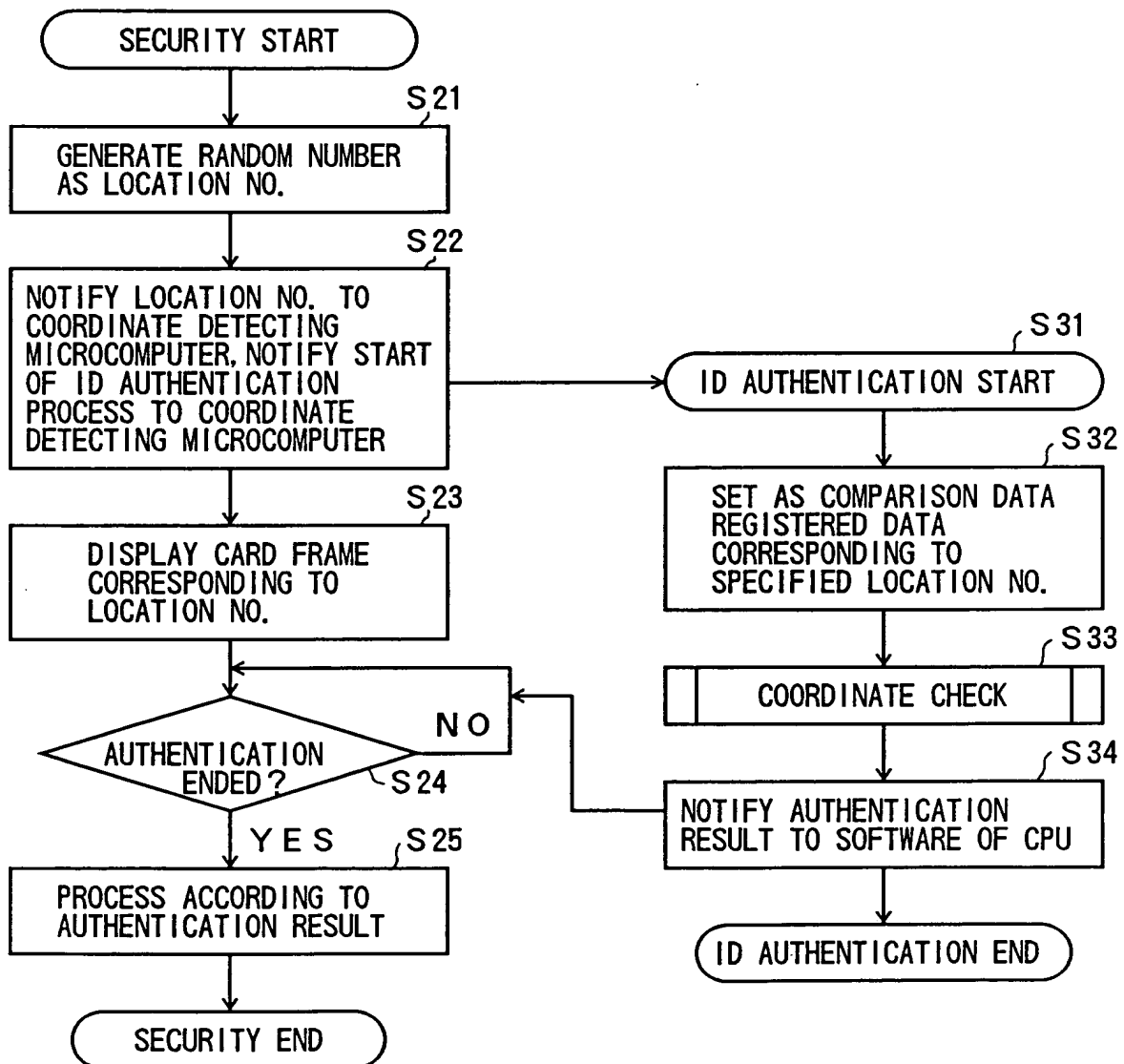
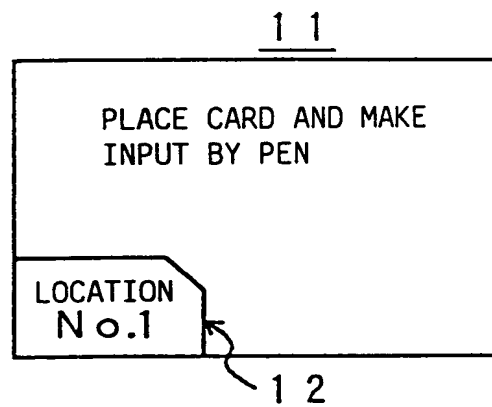


FIG. 3

FIG. 4



TOP SECRET

TOP SECRET

FIG. 5A

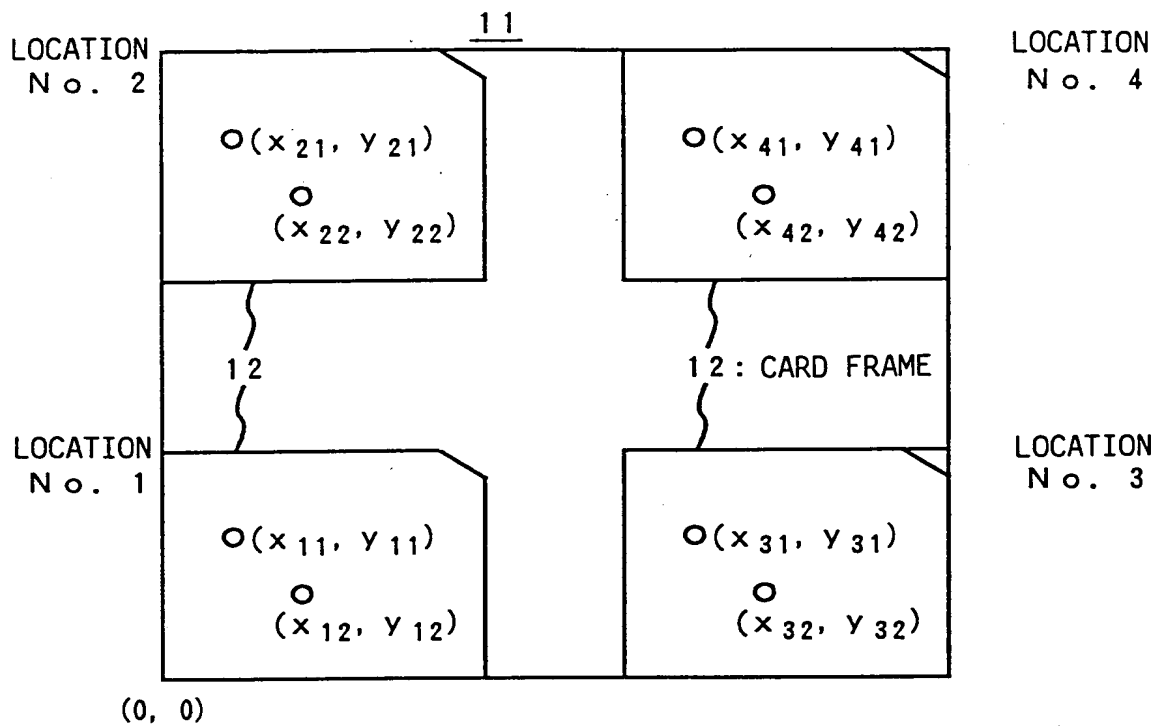


FIG. 5B

LOCATION No.	POINT No.	COORDINATE
1	1	$(x_{11}, y_{11})$
	2	$(x_{12}, y_{12})$
2	1	$(x_{21}, y_{21})$
	2	$(x_{22}, y_{22})$
3	1	$(x_{31}, y_{31})$
	2	$(x_{32}, y_{32})$
4	1	$(x_{41}, y_{41})$
	2	$(x_{42}, y_{42})$

TOP SECRET

FIG. 6A

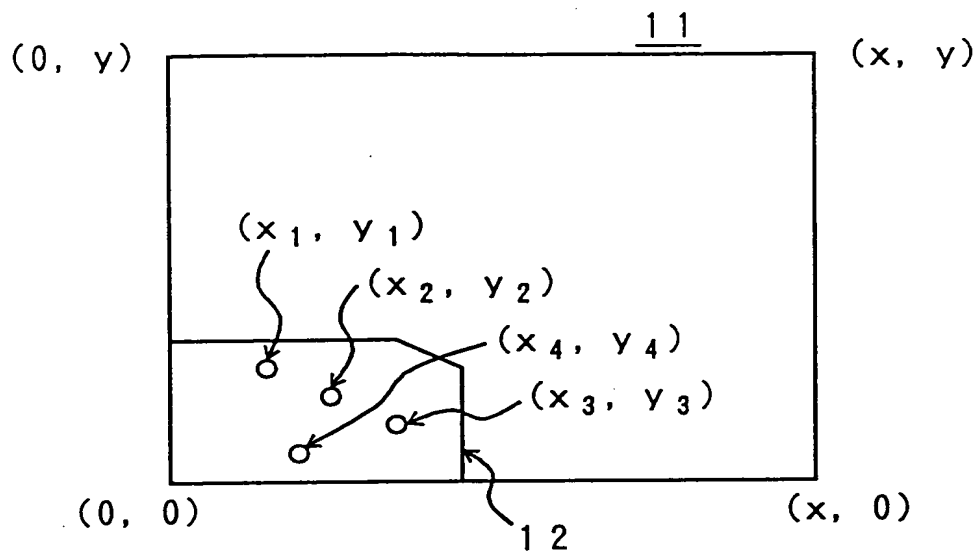
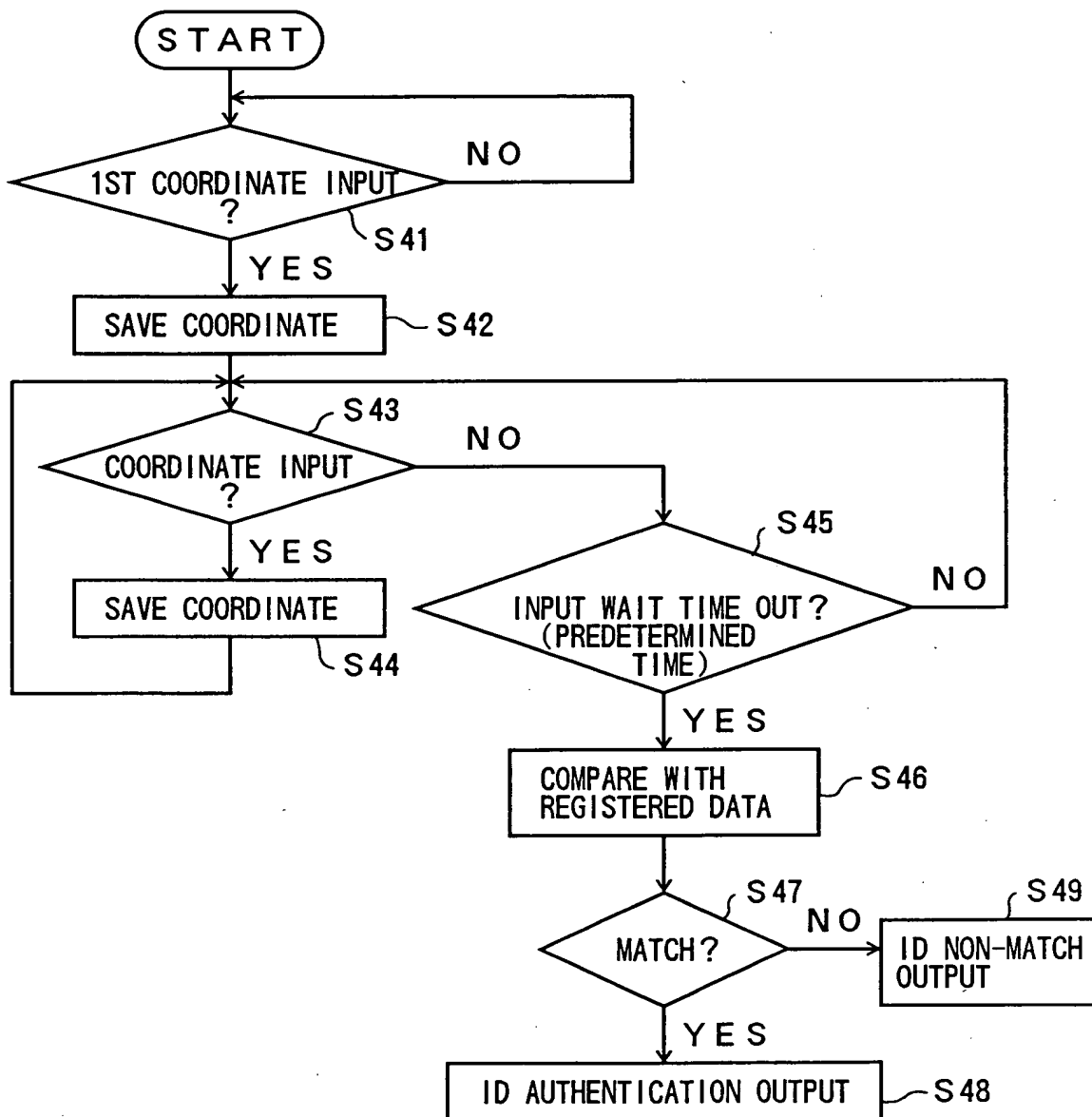


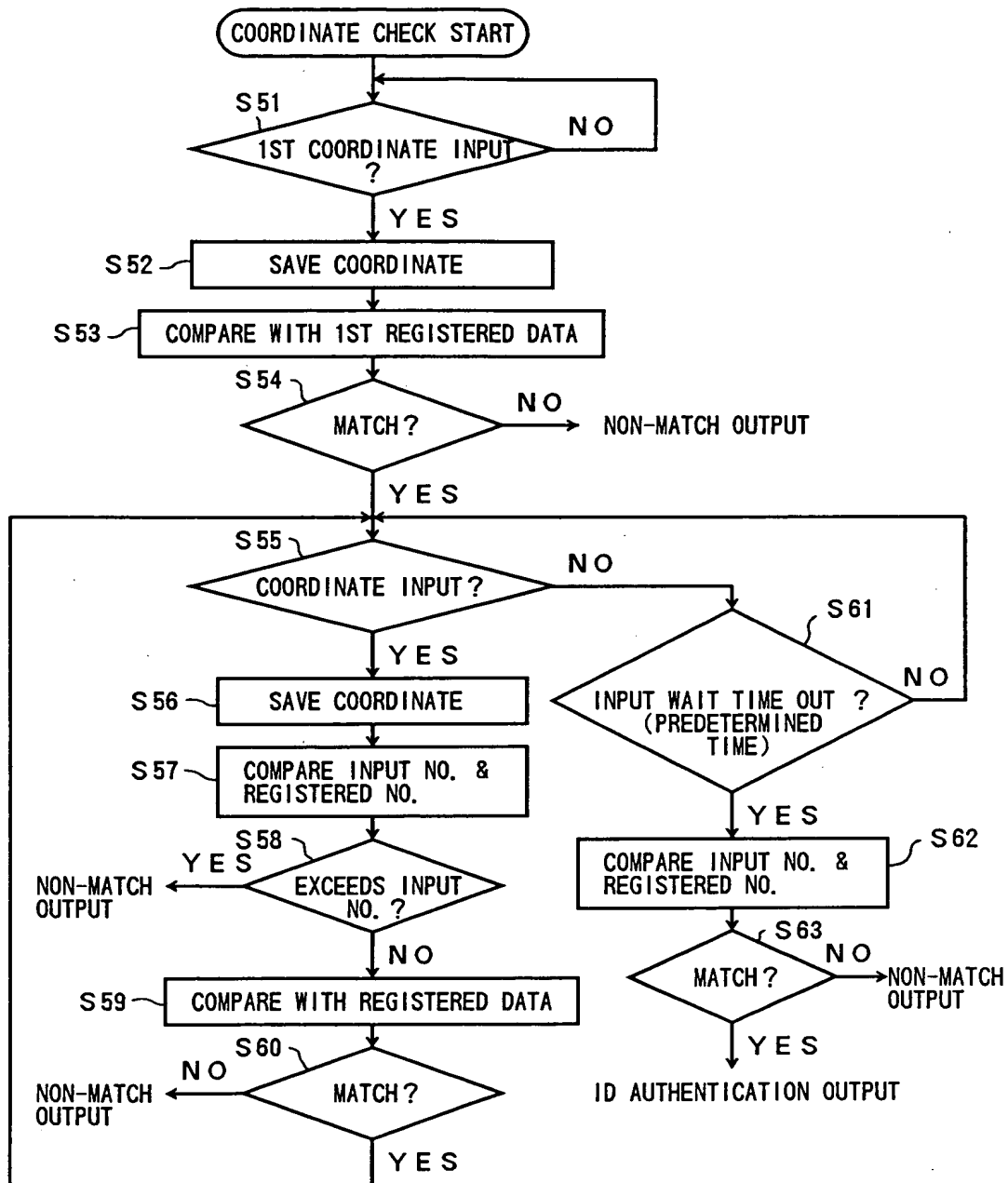
FIG. 6B

No.	COORDINATE
1	$(x_1, y_1)$
2	$(x_2, y_2)$
3	$(x_3, y_3)$
4	$(x_4, y_4)$

FIG. 7



# FIG. 8

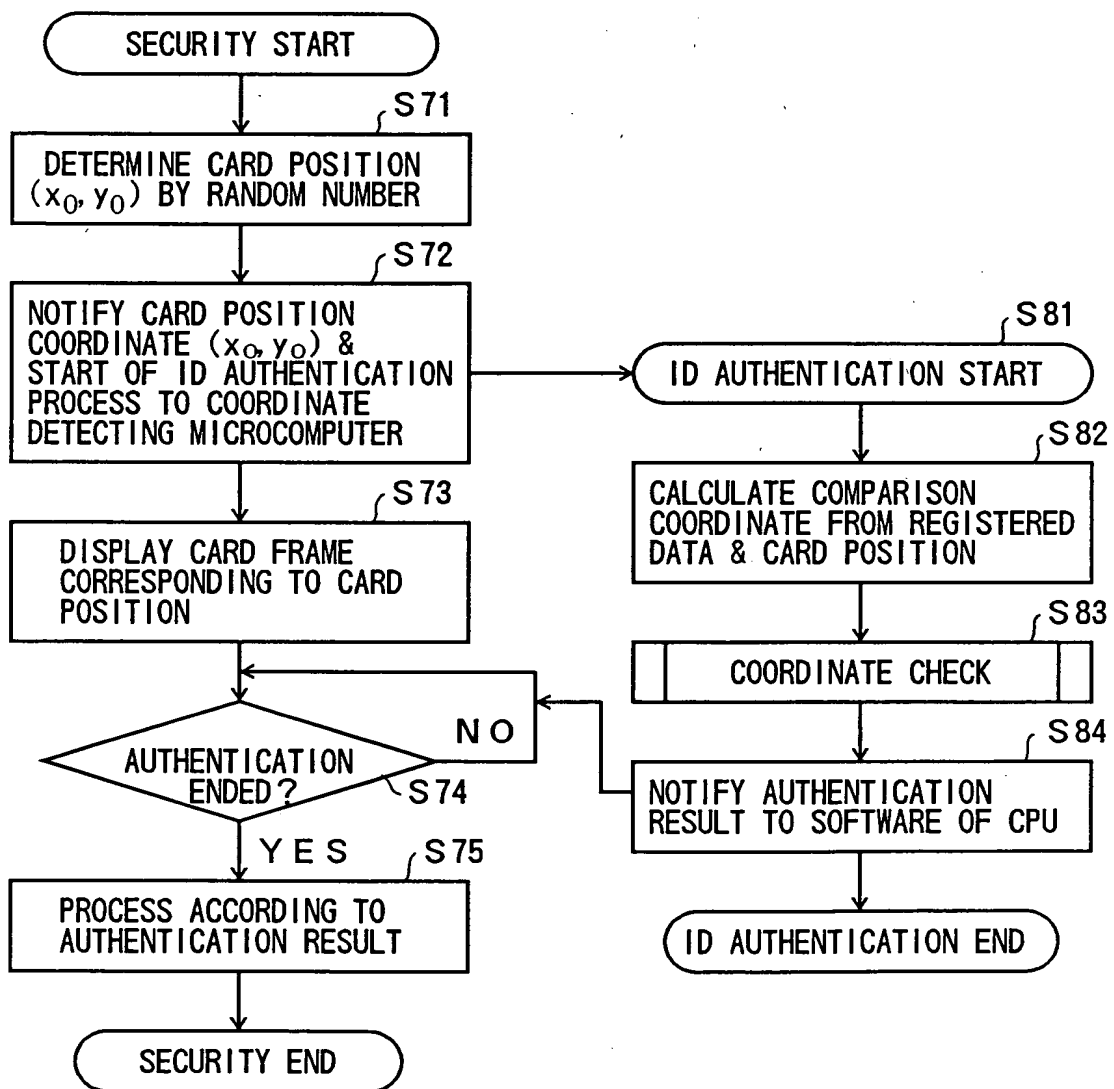




# FIG. 9

SOFTWARE OF CPU 1

COORDINATE DETECTING  
MICROCOMPUTER 4



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FIG. 10A

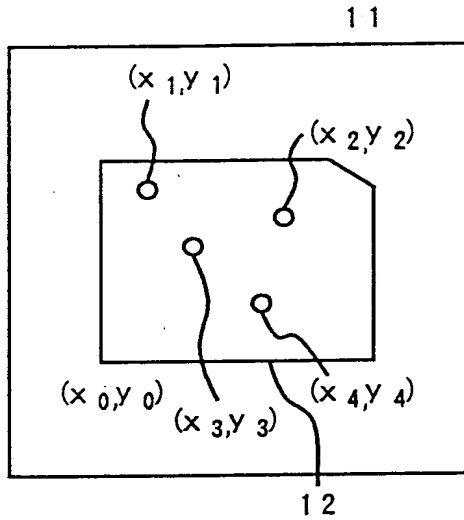


FIG. 10B

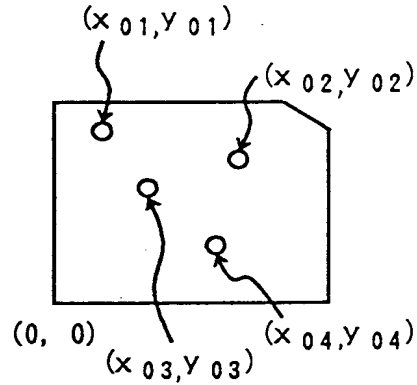


FIG. 10C

POINT No.	CARD ORIGIN	HOLE COORDINATE VALUE WITHIN CARD	COMPARISON COORDINATE
1	$(x_0, y_0)$	$(x_{01}, y_{01})$	$(x_1, y_1) = (x_0 + x_{01}, y_0 + y_{01})$
2		$(x_{02}, y_{02})$	$(x_2, y_2) = (x_0 + x_{02}, y_0 + y_{02})$
3		$(x_{03}, y_{03})$	$(x_3, y_3) = (x_0 + x_{03}, y_0 + y_{03})$
4		$(x_{04}, y_{04})$	$(x_4, y_4) = (x_0 + x_{04}, y_0 + y_{04})$

↑  
REGISTERED DATA

↑  
DATA RECEIVED FROM CPU

↑  
OBTAIN DATA FOR COMPARISON WITH ACTUALLY DETECTED COORDINATE FOR AUTHENTICATION BY CALCULATION PRIOR TO AUTHENTICATION

# FIG. 11

## SOFTWARE OF CPU 1

## COORDINATE DETECTING MICROCOMPUTER 4

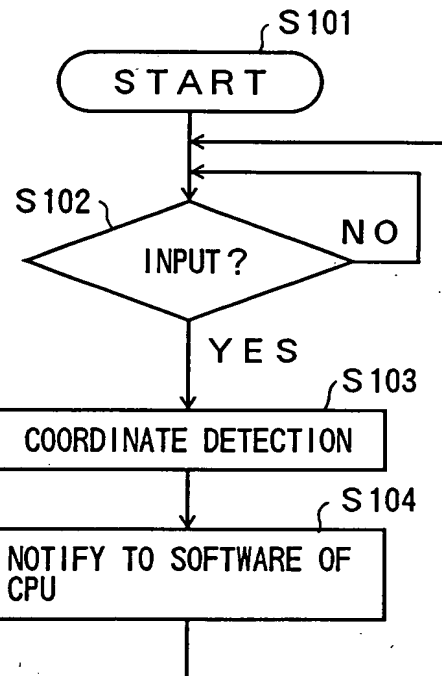
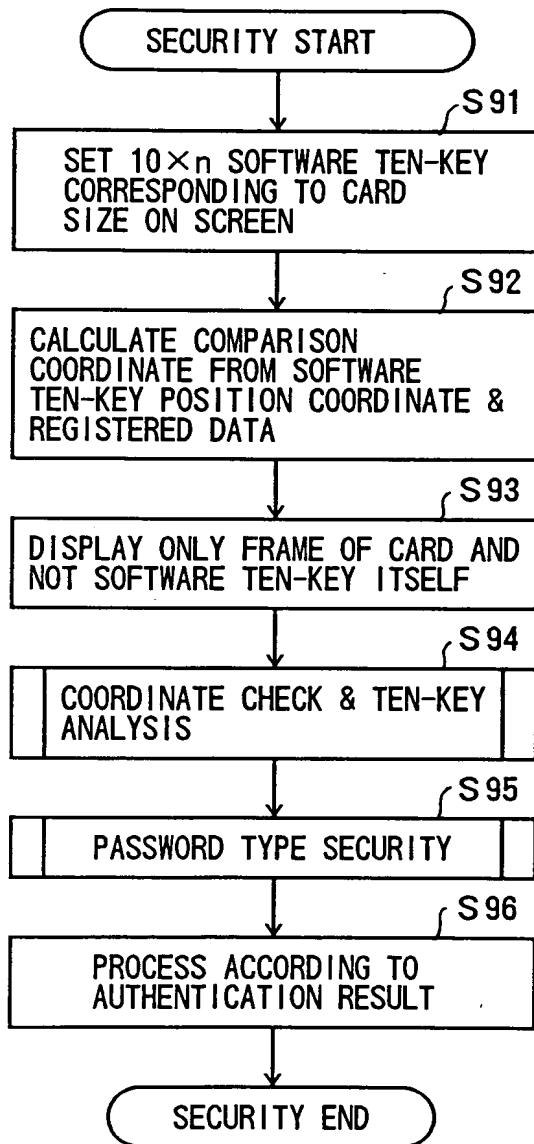
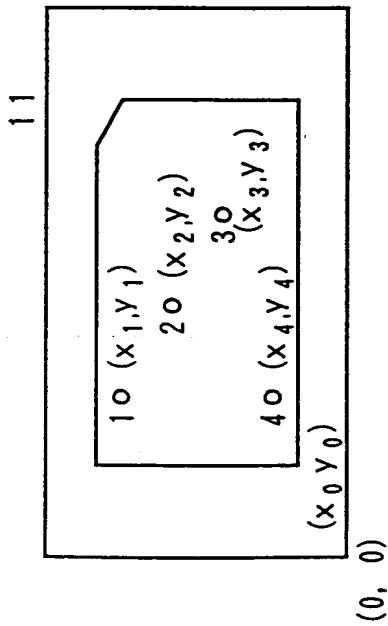


FIG. 11

FIG. 12C



POINT	INPUT COORDINATE VALUE
1	(x <sub>1</sub> , y <sub>1</sub> )
2	(x <sub>2</sub> , y <sub>2</sub> )
3	(x <sub>3</sub> , y <sub>3</sub> )
4	(x <sub>4</sub> , y <sub>4</sub> )

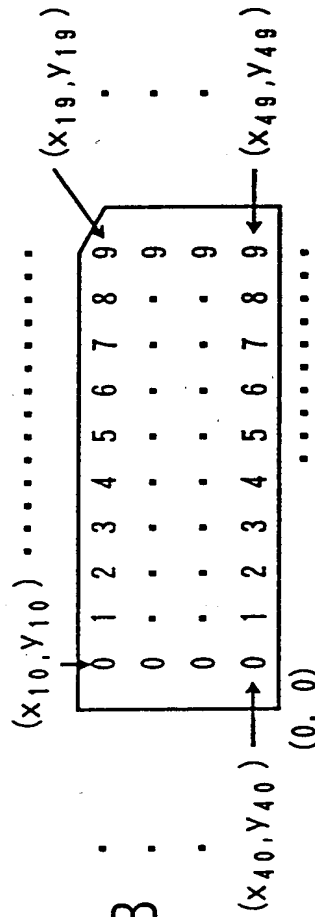


FIG. 12B

FIG. 12D

POINT No.	RECEIVED COORDINATE	ORIGIN COORDINATE OF SOFTWARE TEN-KEY	COMPARISON COORDINATE OF SOFTWARE TEN-KEY	COMPARISON RESULT	RESULT
1	(x <sub>1</sub> , y <sub>1</sub> )	(x <sub>0</sub> , y <sub>0</sub> )	(x <sub>1</sub> ' , y <sub>1</sub> ' ) = (x <sub>1</sub> - x <sub>0</sub> , y <sub>1</sub> - y <sub>0</sub> )	(x <sub>12</sub> , y <sub>12</sub> )	2
2	(x <sub>2</sub> , y <sub>2</sub> )		(x <sub>2</sub> ' , y <sub>2</sub> ' ) = (x <sub>2</sub> - x <sub>0</sub> , y <sub>2</sub> - y <sub>0</sub> )	(x <sub>22</sub> , y <sub>22</sub> )	6
3	(x <sub>3</sub> , y <sub>3</sub> )		(x <sub>3</sub> ' , y <sub>3</sub> ' ) = (x <sub>3</sub> - x <sub>0</sub> , y <sub>3</sub> - y <sub>0</sub> )	(x <sub>32</sub> , y <sub>32</sub> )	9
4	(x <sub>4</sub> , y <sub>4</sub> )		(x <sub>4</sub> ' , y <sub>4</sub> ' ) = (x <sub>4</sub> - x <sub>0</sub> , y <sub>4</sub> - y <sub>0</sub> )	(x <sub>42</sub> , y <sub>42</sub> )	2

COMPARE WITH (x<sub>10</sub>, y<sub>10</sub>) ~ (x<sub>40</sub>, y<sub>40</sub>)

↓

OUTPUT KEY CODE "2 6 9 2"

FIG. 13A

POINT NO.	DETECTED COORDINATE FROM CPU	CARD ORIGIN COORDINATE FROM CPU	COMPARISON COORDINATE OF SOFTWARE TEN-KEY	COMPARISON RESULT
1	$(x_1, y_1)$	$(x_0, y_0)$	$(x_1' y_1') = (x_1 - x_0, y_1 - y_0)$	$(x_{12}, y_{12})$
2	$(x_2, y_2)$		$(x_2' y_2') = (x_2 - x_0, y_2 - y_0)$	$(x_{26}, y_{26})$
3	$(x_3, y_3)$		$(x_3' y_3') = (x_3 - x_0, y_3 - y_0)$	$(x_{39}, y_{39})$
4	$(x_4, y_4)$		$(x_4' y_4') = (x_4 - x_0, y_4 - y_0)$	$(x_{42}, y_{42})$

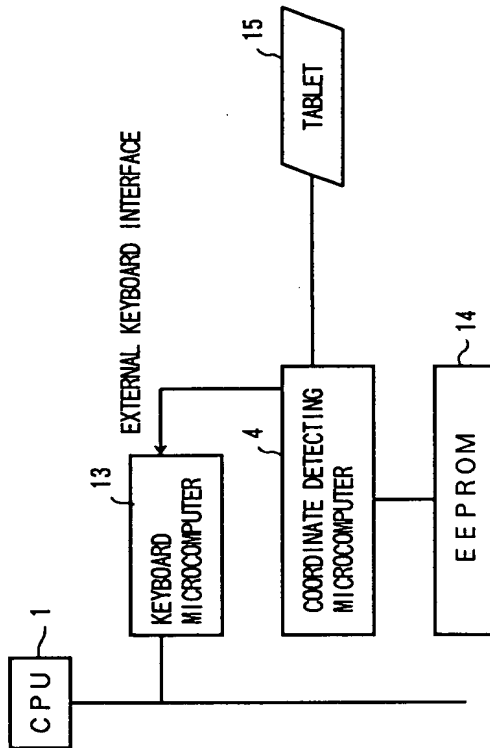


FIG. 13B

# FIG. 14

SOFTWARE OF CPU 1

COORDINATE DETECTING  
MICROCOMPUTER 4

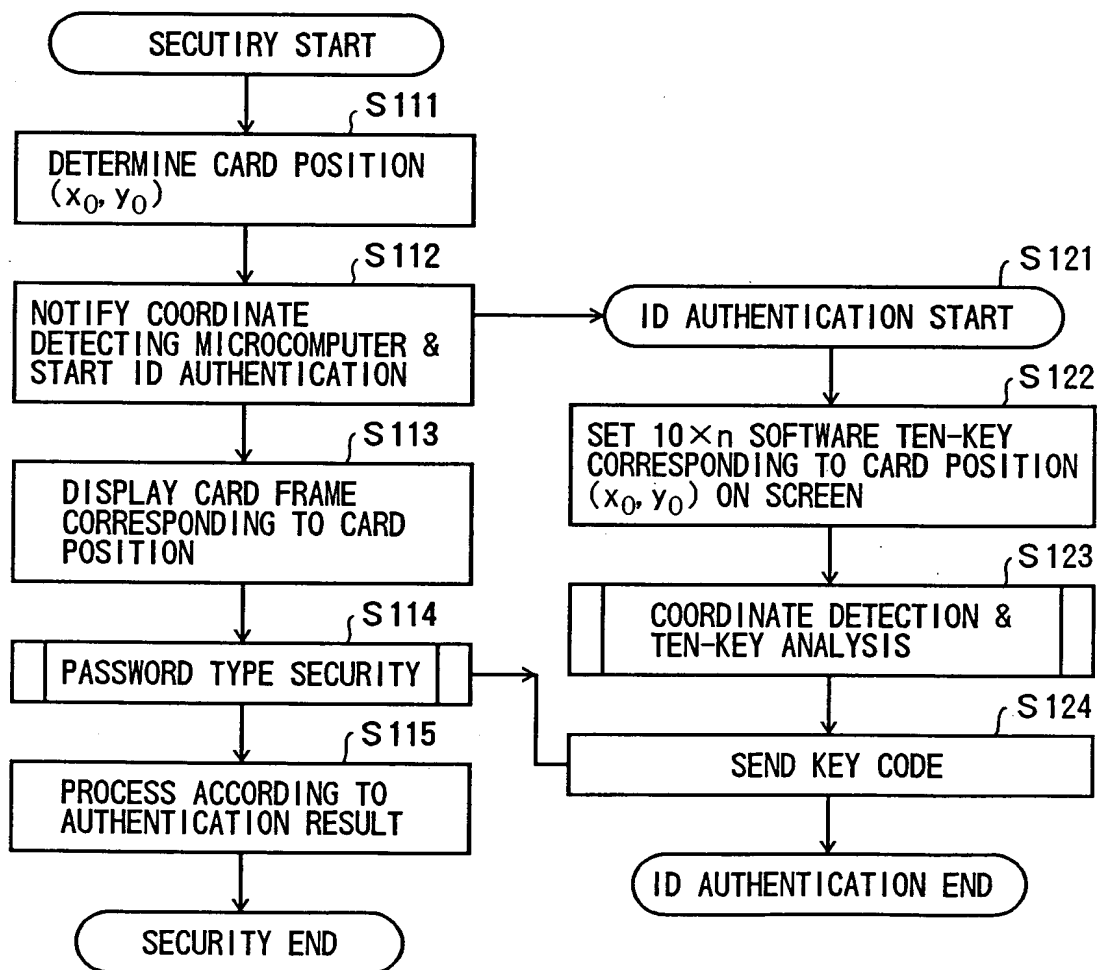


FIG. 15A

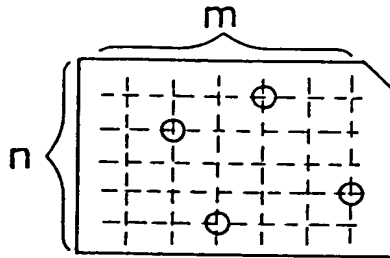


FIG. 15B

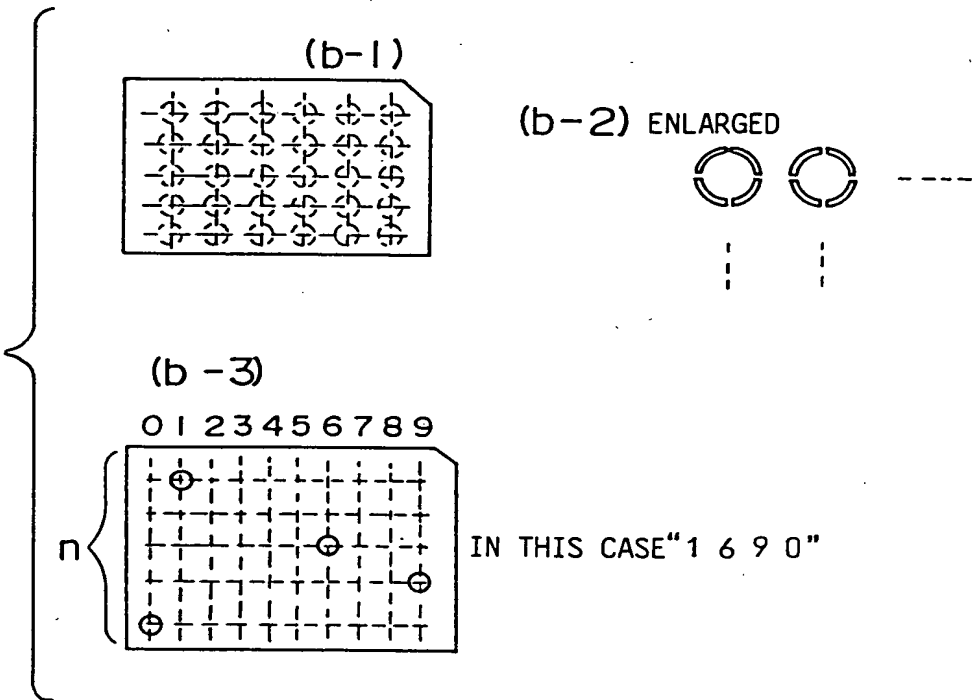
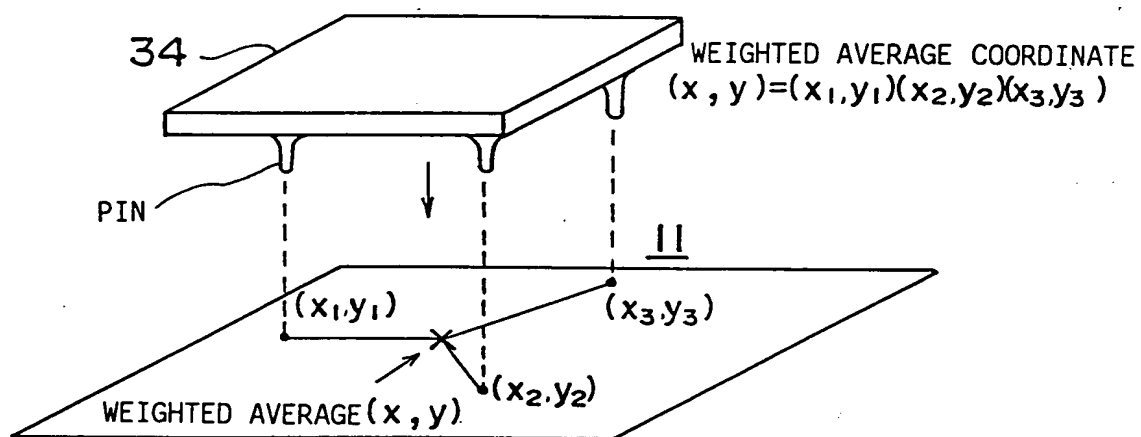


FIG. 16





# FIG. 17

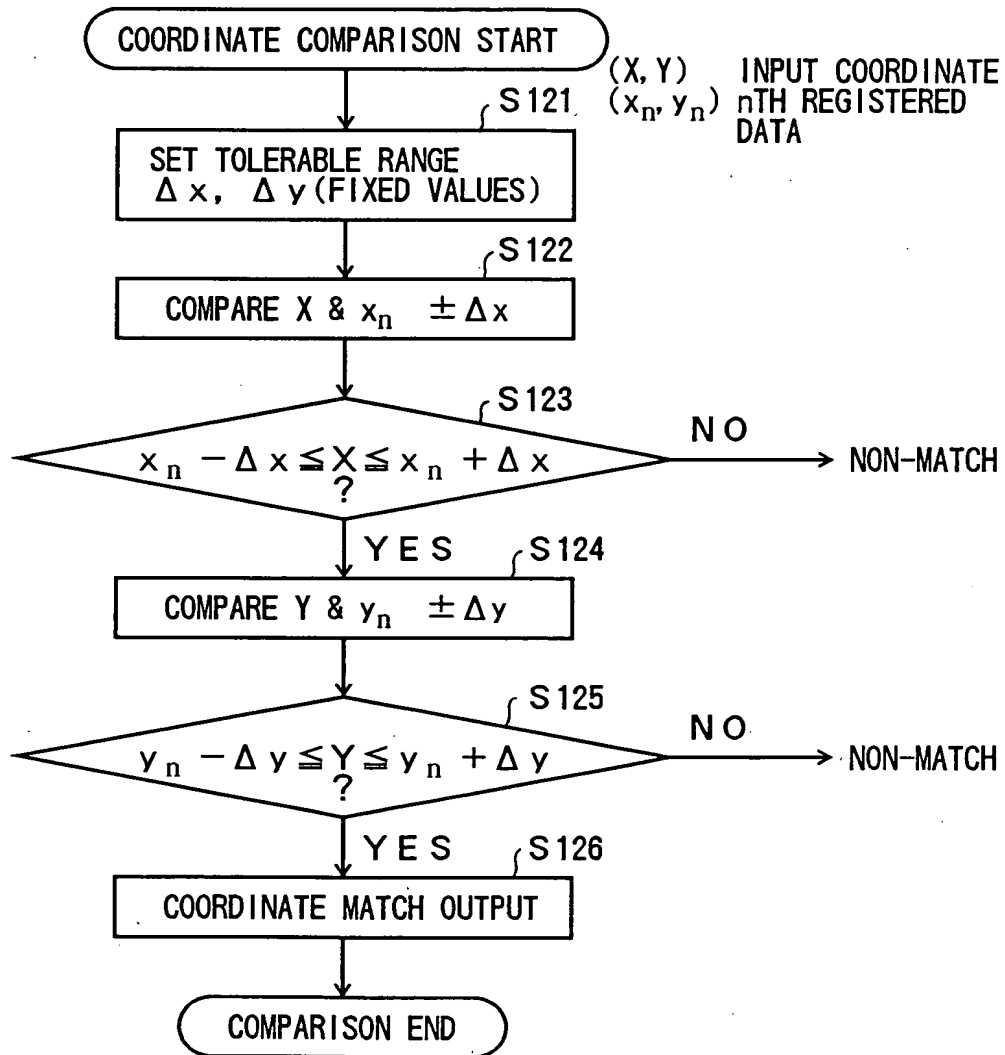


FIG. 18A

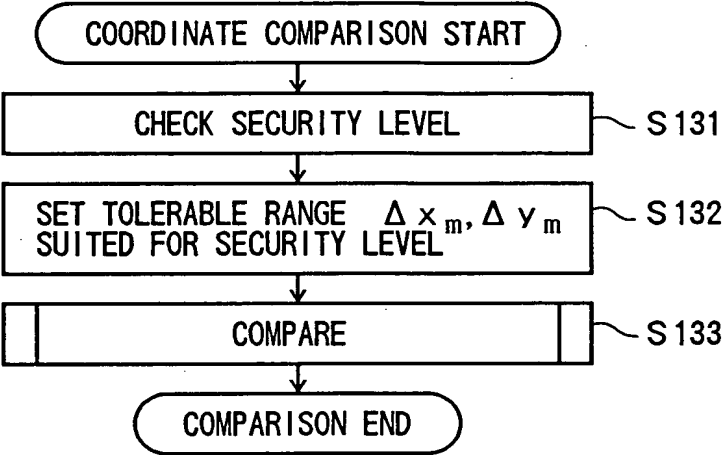


FIG. 18B

SECURITY LEVEL	TOLERABLE RANGE
1	( $\Delta x_1$ , $\Delta y_1$ )
⋮	⋮
m	( $\Delta x_m$ , $\Delta y_m$ )
⋮	⋮
ℓ	( $\Delta x_\ell$ , $\Delta y_\ell$ )

WHERE

$$\begin{matrix} \Delta x_1 > \cdots > \Delta x_m > \cdots > \Delta x_\ell \\ \Delta y_1 > \cdots > \Delta y_m > \cdots > \Delta y_\ell \end{matrix}$$

FIG. 19A

POINT NO.	CARD ORIGIN	REGISTERED DATA OF HOLE COORDINATES WITHIN CARD	COMPARISON COORDINATE RANGE
			min
1	$(x_0, y_0)$ TOLERABLE RANGE $(\Delta x_0, \Delta y_0)$	$(x_{01}, y_{01})$	$(x_0 - \Delta x_0 + x_{01}, y_0 - \Delta y_0 + y_{01})$
2		$(x_{02}, y_{02})$	$(x_0 - \Delta x_0 + x_{02}, y_0 - \Delta y_0 + y_{02})$
3		$(x_{03}, y_{03})$	$(x_0 - \Delta x_0 + x_{03}, y_0 - \Delta y_0 + y_{03})$
4		$(x_{04}, y_{04})$	$(x_0 - \Delta x_0 + x_{04}, y_0 - \Delta y_0 + y_{04})$

FIG. 19B

max
$(x_0 + \Delta x_0 + x_{01}, y_0 + \Delta y_0 + y_{01})$
$(x_0 + \Delta x_0 + x_{02}, y_0 + \Delta y_0 + y_{02})$
$(x_0 + \Delta x_0 + x_{03}, y_0 + \Delta y_0 + y_{03})$
$(x_0 + \Delta x_0 + x_{04}, y_0 + \Delta y_0 + y_{04})$

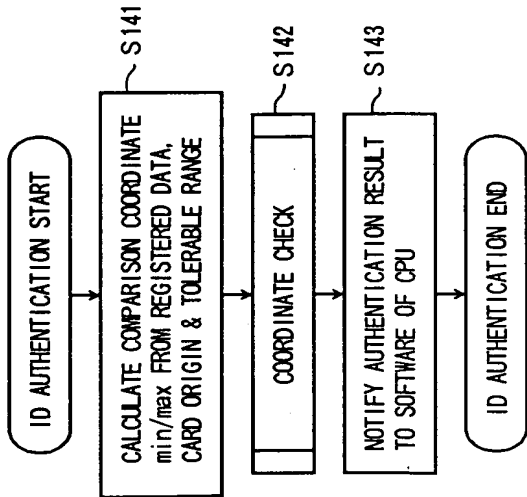


FIG. 20

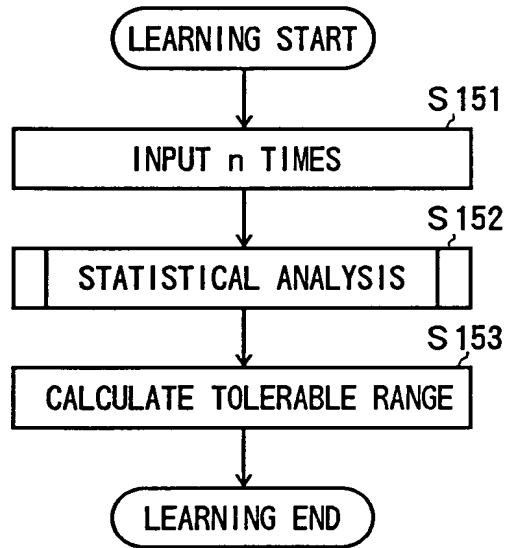
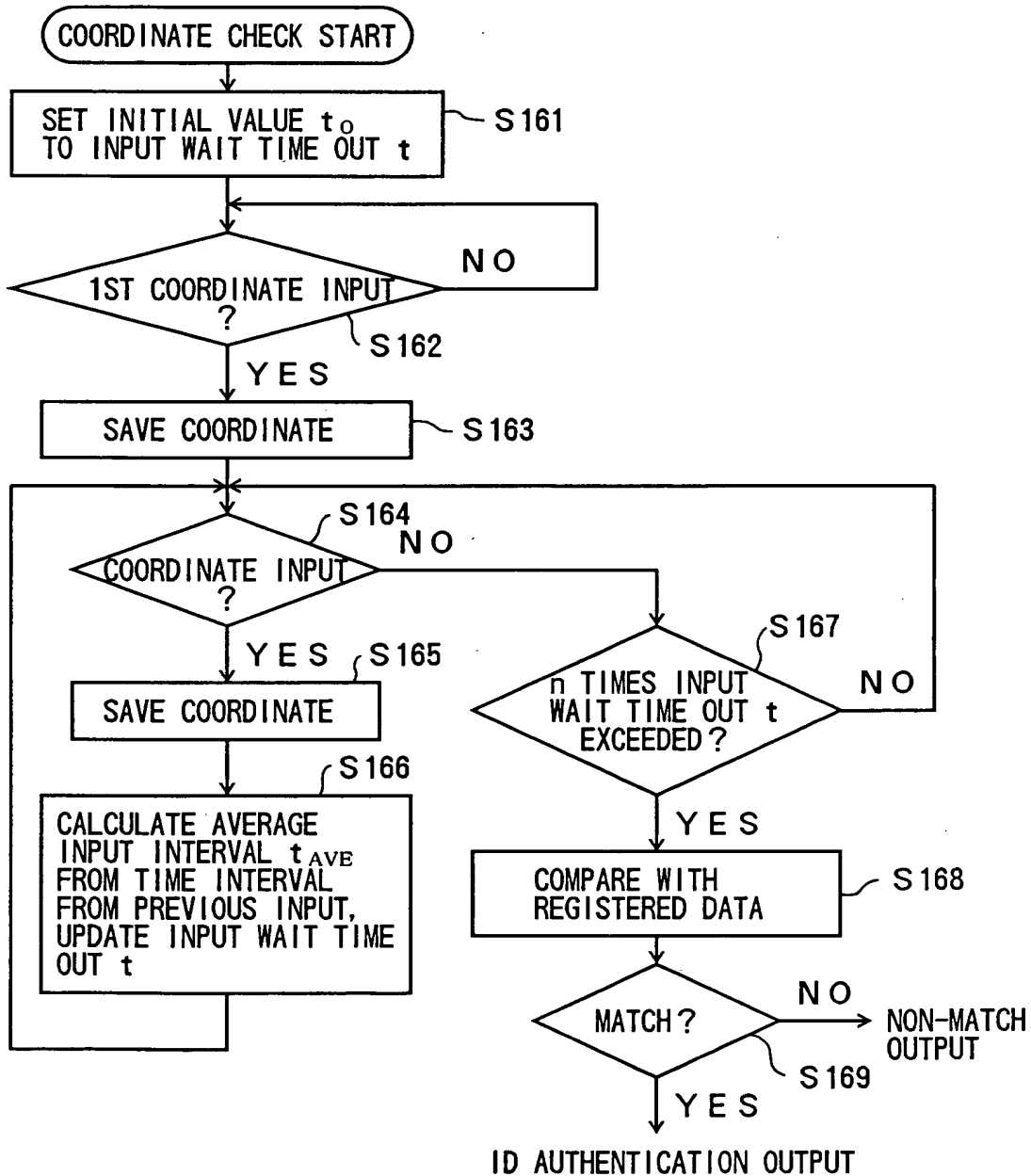
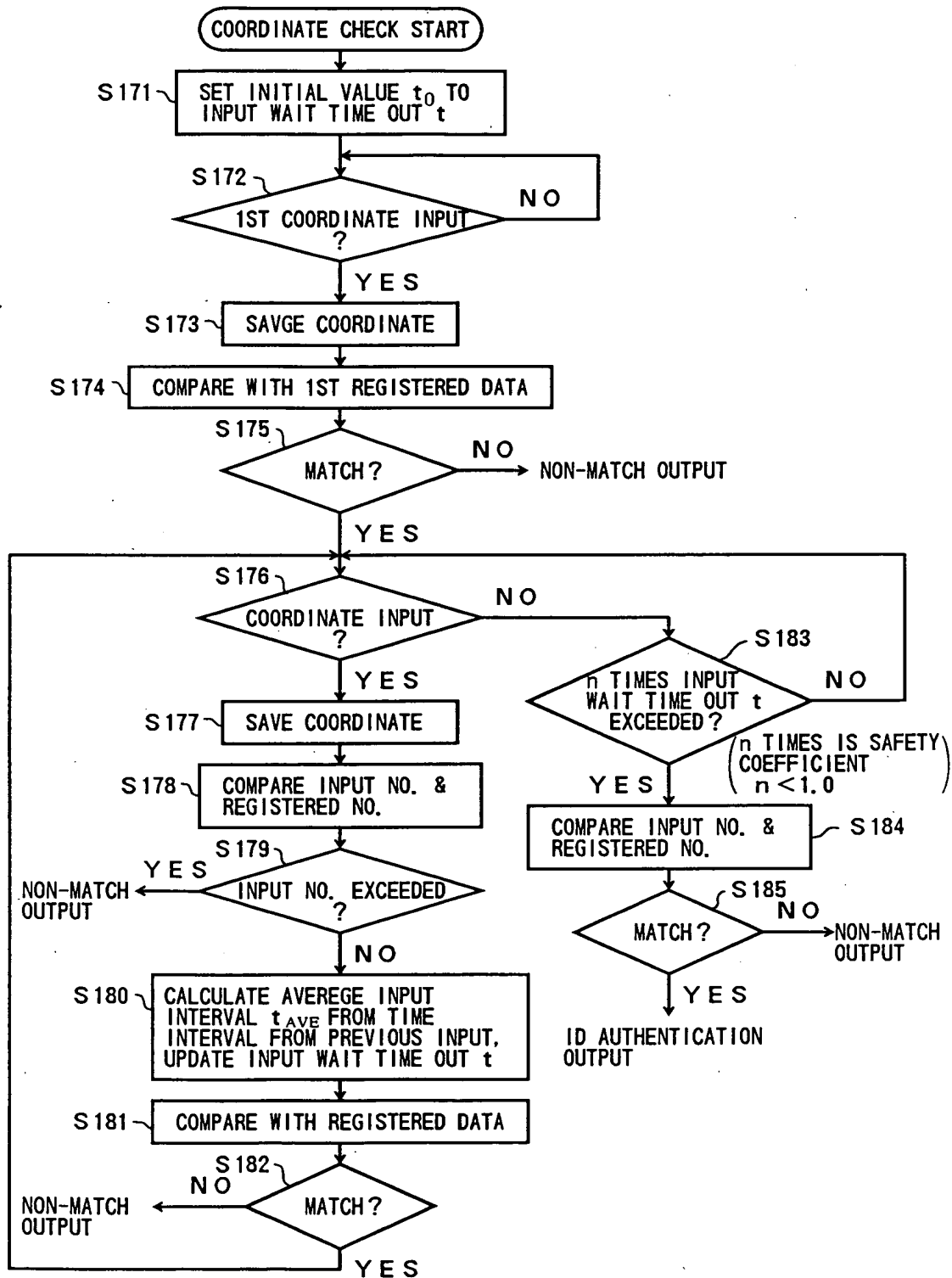


FIG. 21



# FIG. 22

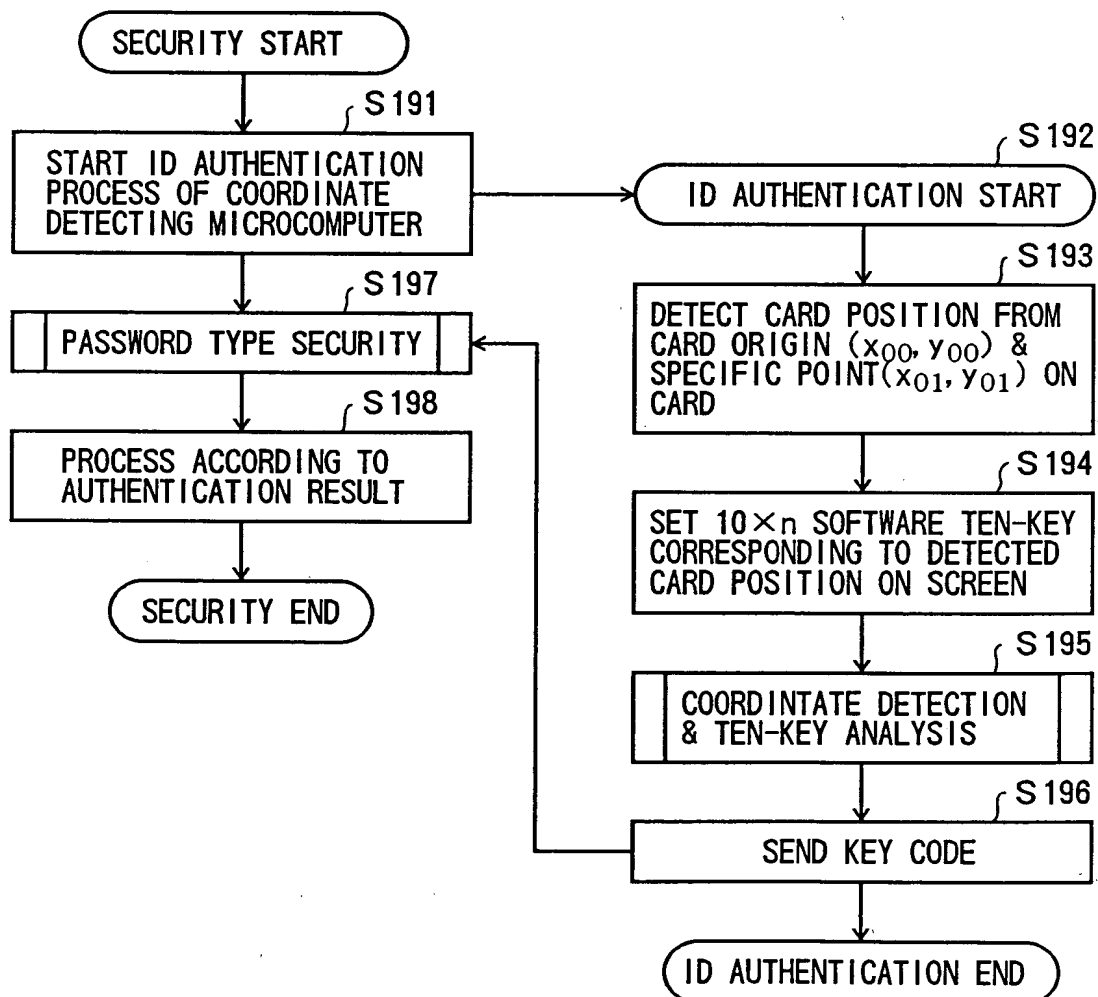


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# FIG. 23

SOFTWARE OF CPU 1

COORDINATE DETECTING  
MICROCOMPUTER 4



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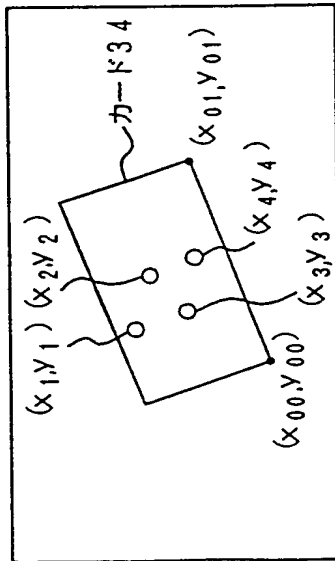


FIG. 24A

FIG. 24B

POINT DETECTED		CARD POSITION		SOFTWARE TEN-KEY		COMPARISON		NUMERICAL	
No. COORDINATE		DETECTION COORDINATE		COMPARISON COORDINATE		RESULT		VALUE	
1	(x <sub>1</sub> ,y <sub>1</sub> )	(x <sub>00</sub> ,y <sub>00</sub> )	(x <sub>01</sub> ,y <sub>01</sub> )	(x <sub>1</sub> <sup>'</sup> ,y <sub>1</sub> <sup>'</sup> ) = (x <sub>00</sub> <sup>'</sup> x <sub>1</sub> cosΔθ-y <sub>1</sub> sinΔθ, y <sub>00</sub> <sup>'</sup> x <sub>1</sub> sinΔθ+y <sub>1</sub> cosΔθ)	(x <sub>12</sub> ,y <sub>12</sub> )	2			
2	(x <sub>2</sub> ,y <sub>2</sub> )	$\sin\Delta\theta=\frac{y_{01}-y_{00}}{l_0}$		(x <sub>2</sub> <sup>'</sup> ,y <sub>2</sub> <sup>'</sup> ) = (x <sub>00</sub> <sup>'</sup> x <sub>2</sub> cosΔθ-y <sub>2</sub> sinΔθ, y <sub>00</sub> <sup>'</sup> x <sub>2</sub> sinΔθ+y <sub>2</sub> cosΔθ)	(x <sub>22</sub> ,y <sub>22</sub> )	6			
3	(x <sub>3</sub> ,y <sub>3</sub> )	$\cos\Delta\theta=\frac{x_{01}-x_{00}}{l_0}$		(x <sub>3</sub> <sup>'</sup> ,y <sub>3</sub> <sup>'</sup> ) = (x <sub>00</sub> <sup>'</sup> x <sub>3</sub> cosΔθ-y <sub>3</sub> sinΔθ, y <sub>00</sub> <sup>'</sup> x <sub>3</sub> sinΔθ+y <sub>3</sub> cosΔθ)	(x <sub>32</sub> ,y <sub>32</sub> )	9			
4	(x <sub>4</sub> ,y <sub>4</sub> )	l <sub>0</sub> : DISTANCE BETWEEN POSITIONING HOLES		(x <sub>4</sub> <sup>'</sup> ,y <sub>4</sub> <sup>'</sup> ) = (x <sub>00</sub> <sup>'</sup> x <sub>4</sub> cosΔθ-y <sub>4</sub> sinΔθ, y <sub>00</sub> <sup>'</sup> x <sub>4</sub> sinΔθ+y <sub>4</sub> cosΔθ)	(x <sub>42</sub> ,y <sub>42</sub> )	2			



# FIG. 25

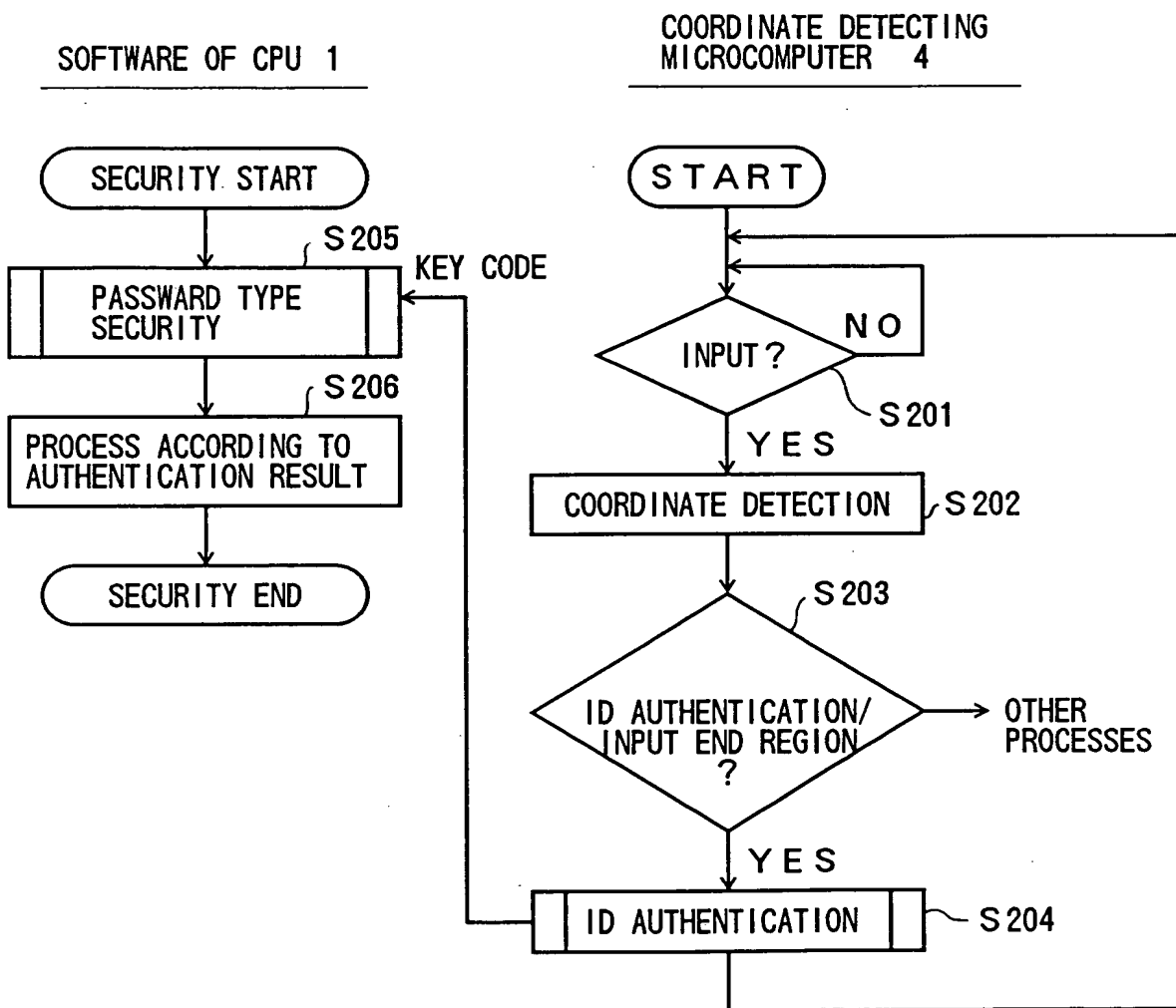


FIG. 26

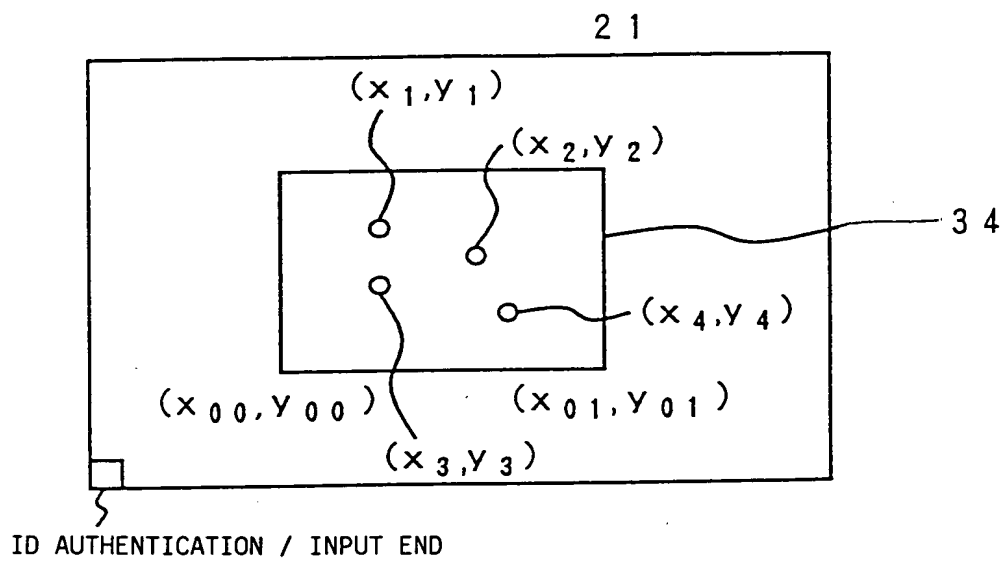
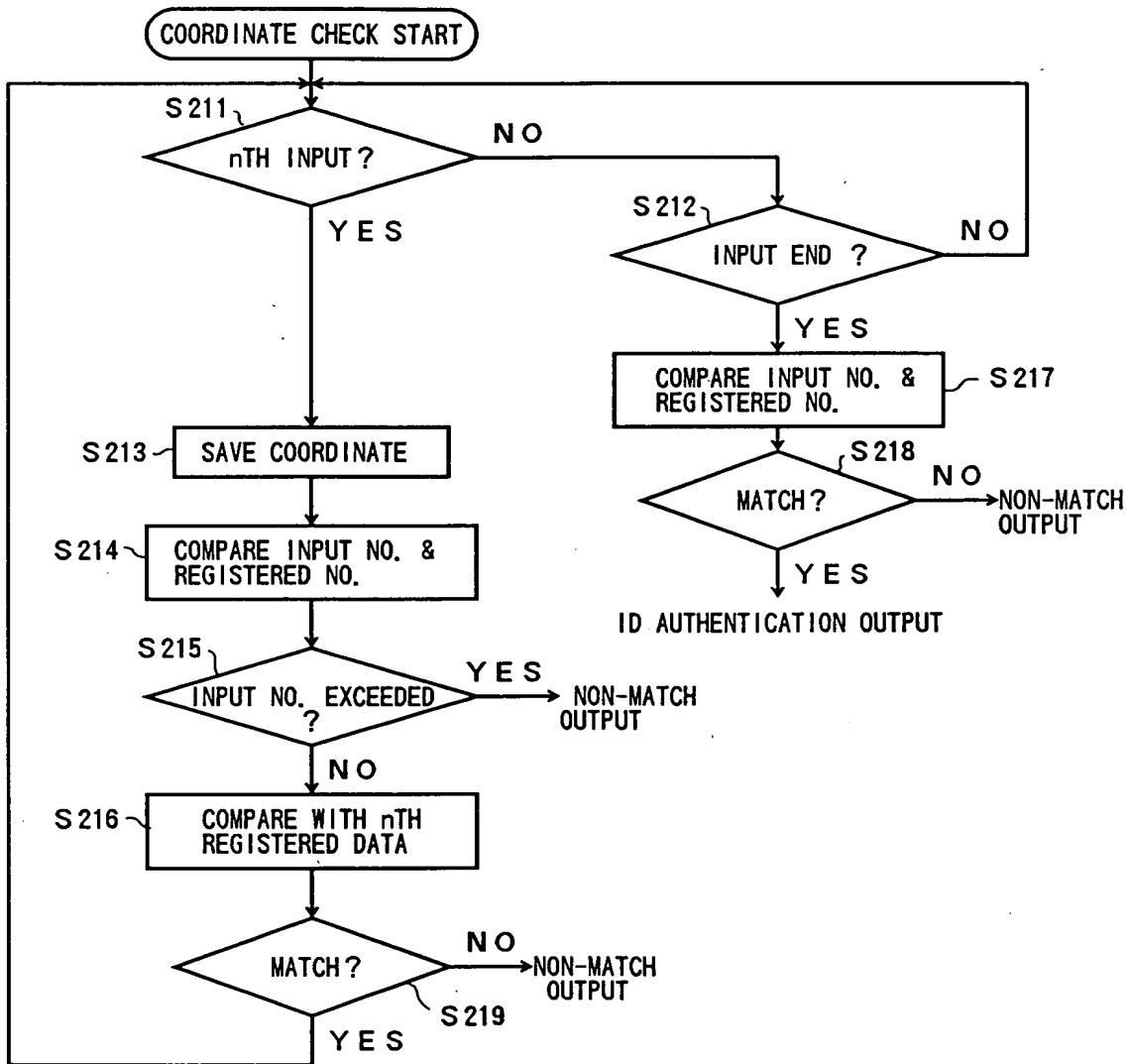


FIG. 26

FIG. 27



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FIG. 28

POINT DETECTED NO. COORDINATE		CARD POSITION DETECTION COORDINATE	COMPARISON COORDINATE	REGISTERED COORDINATE	OUTPUT KEY CODE AFTER ID AUTHENTICATION
1	(x <sub>1</sub> y <sub>1</sub> )	(x <sub>00</sub> y <sub>00</sub> ) (x <sub>01</sub> y <sub>01</sub> ) $\sin \Delta \theta = \frac{y_{01} - y_{00}}{\ell_0}$	(x <sub>00</sub> + x <sub>1</sub> cos Δ θ - y <sub>1</sub> sin Δ θ, y <sub>00</sub> + x <sub>1</sub> sin Δ θ + y <sub>1</sub> cos Δ θ)	(x <sub>1</sub> , y <sub>1</sub> )	2
2	(x <sub>2</sub> y <sub>2</sub> )	$\cos \Delta \theta = \frac{y_{01} - y_{00}}{\ell_0}$	(x <sub>00</sub> + x <sub>2</sub> cos Δ θ - y <sub>2</sub> sin Δ θ, y <sub>00</sub> + x <sub>2</sub> sin Δ θ + y <sub>2</sub> cos Δ θ)	(x <sub>2</sub> , y <sub>2</sub> )	6
3	(x <sub>3</sub> y <sub>3</sub> )	$\sin \Delta \theta = \frac{y_{01} - y_{00}}{\ell_0}$	(x <sub>00</sub> + x <sub>3</sub> cos Δ θ - y <sub>3</sub> sin Δ θ, y <sub>00</sub> + x <sub>3</sub> sin Δ θ + y <sub>3</sub> cos Δ θ)	(x <sub>3</sub> , y <sub>3</sub> )	9
4	(x <sub>4</sub> y <sub>4</sub> )	ℓ <sub>0</sub> : DISTANCE BETWEEN POSITIONING HOLES	(x <sub>00</sub> + x <sub>4</sub> cos Δ θ - y <sub>4</sub> sin Δ θ, y <sub>00</sub> + x <sub>4</sub> sin Δ θ + y <sub>4</sub> cos Δ θ)	(x <sub>4</sub> , y <sub>4</sub> )	2

FIG. 29

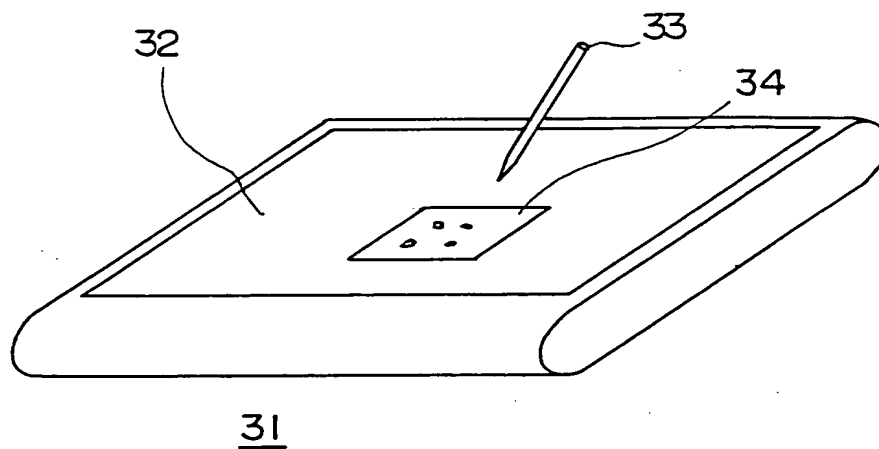


FIG. 30

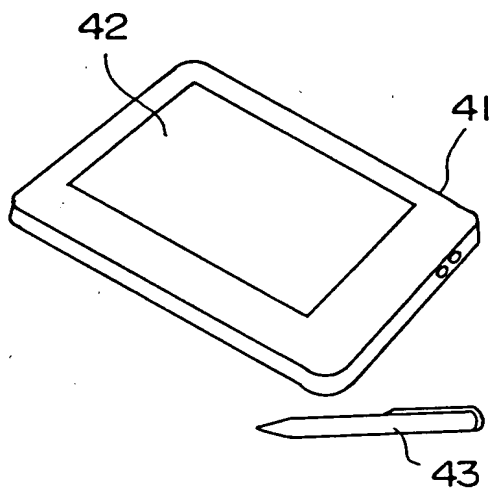


FIG. 31

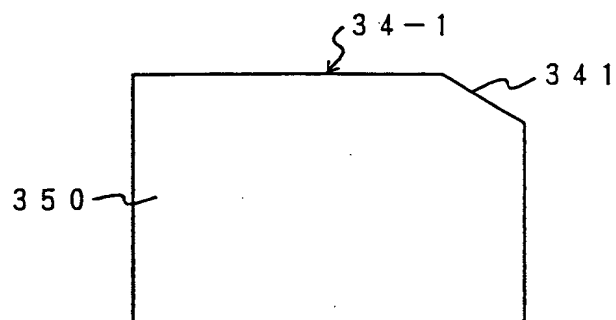


FIG. 32A

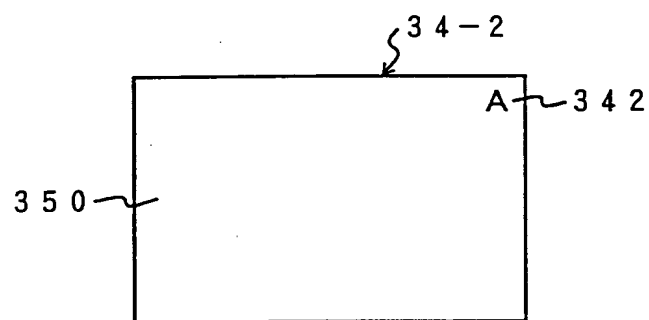


FIG. 32B

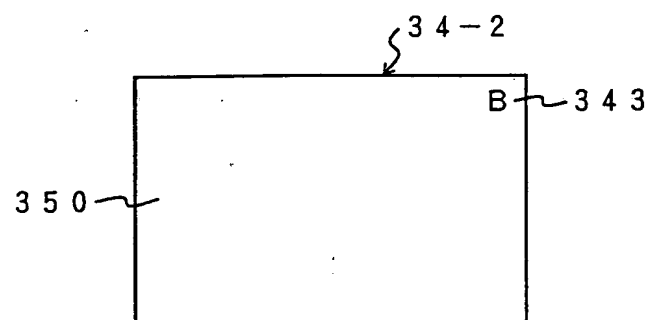


FIG. 33

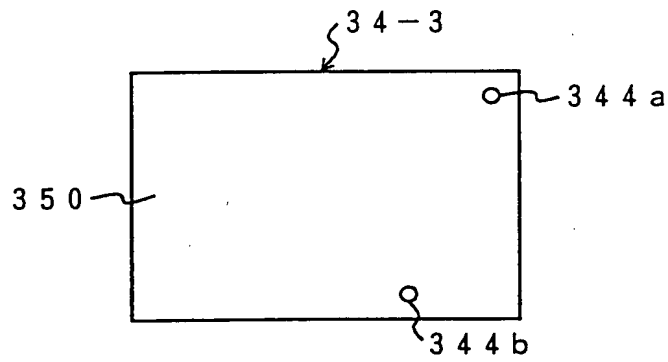


FIG. 34

